Geophysical Research Abstracts
Vol. 19, EGU2017-18375-3, 2017
EGU General Assembly 2017

Contribution of seawater recirculation to submarine groundwater discharge and related nutrient fluxes in two tropical bays

Camille Vautier (1,2,3) and Henrietta Dulaiova (1)

(1) University of Hawai'i at Mānoa, Department of Geology and Geophysics, Honolulu, HI 96822, USA, (2) OSUR-Géosciences Rennes, University of Rennes 1 – CNRS, Rennes, France, (3) ENS de Lyon, Site Monod, 69007 Lyon, France

Hawaiian coastal waters suffer from excess terrestrial nutrient loading, most of which comes from submarine groundwater discharge (SGD). This study quantifies and distinguishes the role of the fresh terrestrial and tidally pumped salt water components of SGD into the nearshore zone of two reefs on the island of Oahu: Maunalua Bay and Kāneohe Bay. The two components of SGD are characterized using isotopic techniques, and the study mainly focuses on the less understood recirculation component. A two-step approach is implemented: first, a conceptual model of groundwater circulation is established; second, nutrient fluxes associated with seawater recirculation are quantified.

Groundwater circulation through the beach berm is quantified and characterized using 222Rn and 224Ra activity measurements. Nutrient fluxes are obtained by coupling nutrient concentration measurements and discharge estimates. The isotopic signatures inform us about the influence of the tidal cycle on groundwater circulation. 222Rn, 224Ra, and δ18O isotopes are used to derive apparent ages of the infiltrated seawater and allow us to quantify recirculation rates. The method is also complemented with the use of silicate concentration as tracers of the recirculation process. The trends in apparent ages observed in pore water in Maunalua match previously published conceptual groundwater circulation models and show a sequentially aging pore water circulation loop. However, the ages obtained in Kāneohe suggest a different tidal pumping dynamic that lacks a circulation loop, perhaps resulting from the absence of freshwater discharge.

Derived nutrient fluxes show that the autochthonous production of inorganic nitrogen and phosphorus that occurs during seawater recirculation has a significant impact on nutrient cycles in the nearshore areas of the bays. This result suggests that seawater recirculation should be taken into account in biogeochemical studies of coastal areas.